REMARKS

Applicants have carefully considered the January 15, 2010 Office Action, and the amendments above together with the comments that follow are presented in a bona fide effort to address all issues raised in that Action and thereby place this case in condition for allowance.

Claims 1-3 and 5-20 are pending in this application. Claims 17-20 have been withdrawn from consideration pursuant to the provisions of 37 C.F.R. § 1.142(b). Claim 1 has been amended. No new matter has been entered. Support for the amendment can be found at least at paragraph [0041] of the published version of the present application. Entry of the present response is respectfully solicited. It is believed that this response places this case in condition for allowance. Hence, prompt favorable reconsideration of this case is solicited.

Applicants gratefully acknowledge the Examiner's courtesy and professionalism in conducting a telephonic interview with the undersigned on March 9, 2010 to discuss the Final Office Action. The Examiner indicated that the proposed language to recite a polycrystalline diamond coating rather than a double crystal structure would be strongly considered.

Claim 1, as amended, now describes in pertinent part, that a polycrystalline diamond is an aggregate of secondary diamond grains, each of which includes an aggregate of primary diamond fine grains, the primary diamond fine grains having a first crystal structure and the secondary diamond grains having a second crystal structure different from the first crystal structure. It is submitted that the original specification fully supports the newly added limitations and further distinguishes the present claimed subject matter over the art of record.

Claims 1-3, 5-8, 14 and 16 were rejected under 35 U.S.C. § 103(a) as being obvious over Phillips et al. (U.S. Pat. No. 5,571,615, hereinafter "Phillips") in view of Fontaine et al, *Tribochemistry Between Hydrogen and Diamond-Like Carbon Films*, Surface and Coatings Technology 146-147 (2001) 286-291 (hereinafter "Fontaine"). Applicants traverse.

Phillips fails to disclose or remotely suggest a polycrystalline diamond coating as required in claim 1. The Phillips patent discloses a plurality of grains of a single crystal structure (i.e. monocrystalline). Claim 1, as amended, now describes that the polycrystalline diamond coating is an aggregate of secondary diamond grains, each of which includes an aggregate of primary diamond fine grains, the primary diamond fine grains having a first crystal structure and the secondary diamond grains having a second crystal structure different from the first crystal structure.

As previously submitted in the last response, Applicants have demonstrated that Phillips merely shows elongated diamond grains that extend from a substrate to a surface of a diamond coating in Figure 4 and Phillips neither teaches nor remotely suggests that these diamond grains are further formed of diamond fine grains. The structure of the diamond coating of Phillips can be restated simply as a single crystal structure or monocrystalline. The result of Raman spectroscopic analysis most obviously shows a difference between the crystal structure of the diamond coating of the present subject matter and that of Phillips. Differences in the crystal structure in light of the spectroscopic analysis have been acknowledged by the Examiner at page 6 of the latest Office Action.

Applicants submit that in view of the fact that the crystal structure of the diamond coating of Phillips does not remotely resemble that of the present claimed subject matter, one of ordinary skill in the art would not have found it obvious to conceive the present claimed subject matter.

The result of Raman spectroscopic analysis on the diamond coating of the present subject matter shows a local peak in the vicinity of 1100~1150 cm^{-1}. See FIGS. 9 and 10 of the present specification. This peak is one of physical values specifying a polycrystalline diamond structure. By contrast, the result of Raman spectroscopic analysis on the diamond coating of Phillips does not show a data in the vicinity of 1100~1150 cm^{-1}. See FIG. 5 of Phillips. This is probably due to the fact that a distinctive peak does not exist in the vicinity.

Applicants performed a test to demonstrate that a difference of crystal structure is reflected in a result of Raman spectroscopic analysis. Since Phillips does not teach a producing condition in detail, a diamond coating is formed under a condition adjusted so as to obtain a result which is similar to the result shown in FIG. 5 of Phillips. FIG. 1, reproduced below, is a graph showing a result of Raman spectroscopic analysis of a diamond coating obtained in the test. FIG. 2, also reproduced below, is a SEM photograph showing a cross-sectional surface of the same diamond coating.

FIG. 1

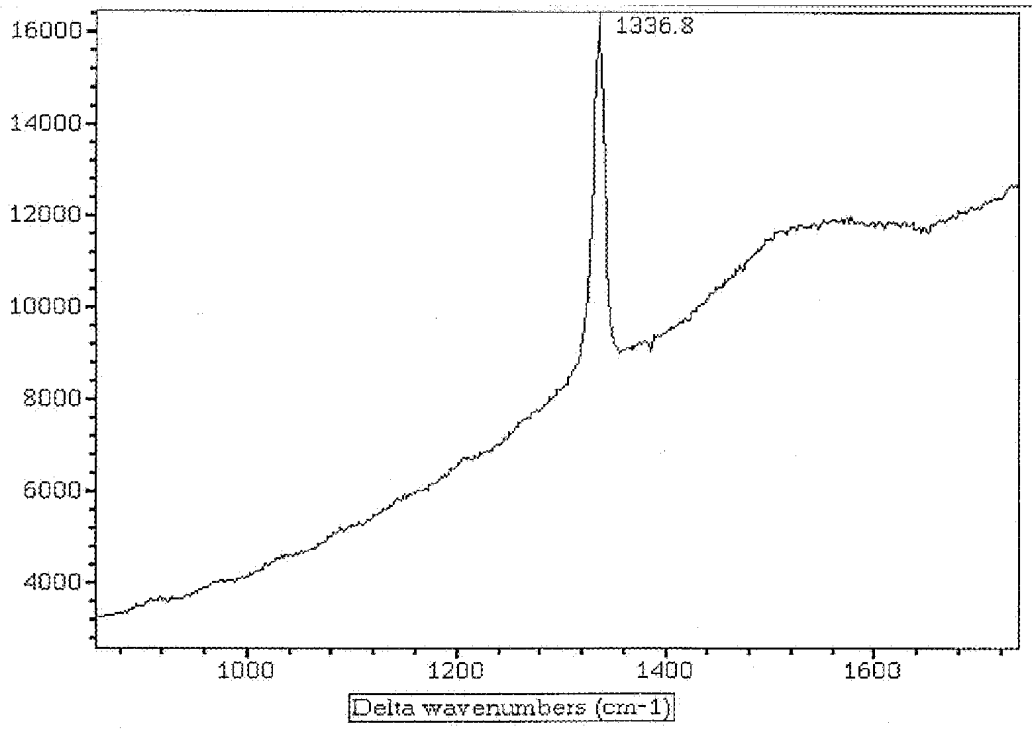
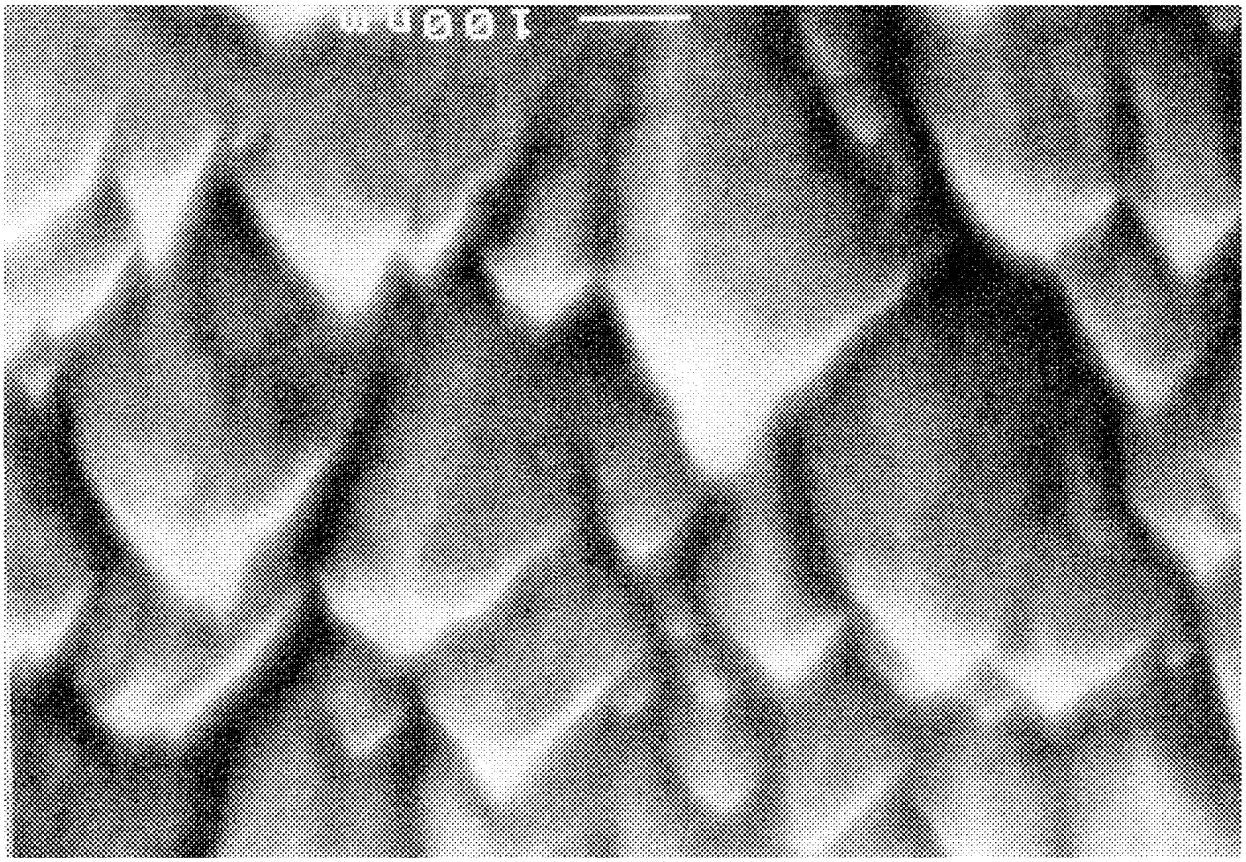

1336.8
16000
14000
12000
10000
8000
6000
4000
1000
1200
1400
1600
Delta wavenumbers (cm-1)

FIG. 2



Referring to FIG. 1 above, while there is a peak in the vicinity of 1330 cm^{-1}, a local peak does not appear in the vicinity of 1100~1150 cm^{-1}, unlike FIGS. 9 and 10 of the present application. This experimental result indicates that the diamond coating produced in the test has a crystal structure similar to that described in the Phillips patent.

Turning attention to FIG. 2 above, the SEM photograph has a scale of nanometer order, that is, FIG. 2 shows an enlarged equivalent of diamond grains of the diamond coating shown in FIG. 4 (micrometer order) of Phillips.

Moreover, FIG. 2 (above) has the same scale as FIG. 7 of the present application (a SEM photograph showing diamond fine grains of the present subject matter). Therefore, by observing FIG. 2 (above) and FIG. 7 of the present application, a comparison of the crystal structure can be made between the diamond coating of Phillips and that of the present claimed subject matter. In fact, the differences are readily apparent when these two figures are compared. More importantly, it is clear that the diamond coatings of Phillips and the present application are totally different in terms of their crystal structures.

Phillips discloses a carbide substrate coated with a diamond film and the diamond film has a thickness of greater than about 10 microns and a grain size of less than about 0.5 microns. The diamond film of Phillips merely has a single crystal structure (monocrystalline) which is totally distinct from the claimed polycrystalline diamond coating which is an aggregate of secondary diamond grains, each of which includes an aggregate of primary diamond fine grains.

In the Interview Summary dated March 11, 2010, the Examiner requested clarification of the process steps used to produce the product as claimed. In response, Applicants note that as described in the present application, the surface of the substrate is carburized before it is coated with a diamond coating by a CVD method. The carburization step before coating and the pressure of an atmosphere during coating, both play crucial roles in forming a polycrystalline diamond coating having primary diamond fine grains and secondary diamond grains. The Examiner's attention is invited to paragraphs [0038], [0039], etc. of the published version of the present application as well as original claim 17.

Further, the temperature during coating (e.g. paragraph [0038]) and a diamond application step for applying a diamond not larger than 50nm in average grain size to the surface of the substrate between the carburization step and coating step are also effective in forming the above diamond coating (e.g. paragraph [0040]).

In contrast, Phillips only teaches that the diamond film is formed by a CVD method. Phillips does not teach or remotely suggest anything about carburization before coating or conditions such as a pressure of an atmosphere for a diamond coating process. Accordingly, it is hardly possible that the diamond film of Phillips has a polycrystalline diamond coating formed of an aggregate of secondary diamond grains, each of which includes an aggregate of primary diamond fine grains (different in structure from the secondary diamond grains) of the present claimed subject matter. Phillips arguably contains "multiple grains", but all the grains in Phillips have the same crystal structure (i.e. a monocrystalline structure).

The secondary reference to Fontaine fails to remedy the above argued deficiency of Phillips. The Examiner appears to rely on Fontaine as evidence that hydrogen effects diamond film structures and properties. See page 4 of the Office Action. Applicants, therefore, respectfully request reconsideration and withdrawal of the obviousness rejection predicated upon Phillips and Fontaine.

With respect to dependent claim 8, Applicants emphasize that there is absolutely no relation between a polycrystalline structure and that of forming the diamond coating as a single layer or multiple layers. The polycrystalline diamond coating of the present claimed subject matter formed as a single layer has a polycrystalline crystal structure within the single layer.

The same is true for a second polycrystalline diamond coating layer formed on top of the first layer.

Dependent claims 9-13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Phillips in view of Fontaine and further in view of Kembaiyan et al. (U.S. Pat. App. Pub. No. 2004/0060742, hereinafter "Kembaiyan"). Applicants traverse.

Applicants incorporate herein the arguments previously advanced in traversal of the rejection under 35 U.S.C. § 103(a) predicated upon Phillips and Fontaine. The tertiary reference to Kembaiyan does not cure the argued deficiencies of Phillips and Fontaine. Kembaiyan discloses cutters for earth-boring drill bits made from a tungsten carbide and having a diamond layer covering the cutting face. It is assumed that the diamond layer is formed thick as the invention of Kembaiyan is related to the earth-boring drill bits (as shown in Figure 1 and paragraph [0005]).

It can be hardly said that a base rock subjected to cutting would require excellent work surface roughness as in the field of micro processing to which the present subject matter is related. Accordingly, it can be considered that the diamond layer disclosed in Kembaiyan has neither a surface as smooth as it is defined in the claim 1 of the present application, nor a polycrystalline diamond crystal structure to achieve a smooth surface. Thus, even if the applied references are combined as suggested by the Examiner, the claimed subject matter will not result. *Uniroyal, Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988). If any independent claim is non-obvious under 35 U.S.C. § 103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

It is believed that pending claims 1-3 and 5-16 are now in condition for allowance. Applicants therefore respectfully request an early and favorable reconsideration and allowance of this application. If there are any outstanding issues which might be resolved by an interview or an Examiner's amendment, the Examiner is invited to call Applicants' representative at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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